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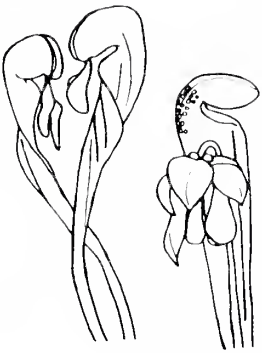
CARNIVOROUS PLANT NEWSLETTER

VOLUME 15, Number 1 MARCH 1986



CARNIVOROUS PLANT NEWSLETTER

Official Journal of the International Carnivorous Plant Society

Volume 15, Number 1
March 1986

COVER PHOTO

Commercial production of *Dionaea* at Cresco nurseries in Holland. (Feature article this issue.)

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to Joanne Klingesmith, 437 Las Riendas, Fullerton, CA 92635. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to ICPS.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the September issue is July 1, 1986.

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NEWS AND VIEWS

BOB BARTLETT (30 Milina St., Hillman, Western Australia 6168) writes: Having known for a couple of years that The Kings Park Botanical Gardens in Perth, Western Australia had some carnivorous plants, it was pleasing to learn recently that they were now on display to the public in a A$350,000 glass house complex that had only recently been built.

I must say that I was very impressed with the display and the amount of space devoted to carnivorous plants. The area is about 70 ft. long by 4 ft. wide and is in one continuous section. The plants are protected by sloping glass which goes back about 30 in., leaving an area vacant for air flow. The *Sarracenia* on display were very impressive, having 30 in. pitchers. The species were *S. alata, leucophylla, psittacina* and *purpurea*. The plants of *S. purpurea* were particularly impressive and the dozen or so on display were quite the best I had ever seen of this species. Separated from the *Sarracenia* species were 30 or so hybrids which unfortunately weren't labeled separately, but several mostly consist of various *S. purpurea* crosses. I was also very impressed with display of *Cephalotus* with some of the clumps about 12 in. in diameter and pitchers 2½ in. long.

I counted eleven species of *Drosera* on display with these being: *D. capillaris, dielsiana, filiformis, adelae, hillaris, spathulata, capensis, rotundifolia, binata, aliciae* and *burkeana*. I must admit to being despondent at not finding any of the W.A. pygmy *Drosera* but these might be added later. Another impressive plant was *Byblis gigantea* which was in full flower at the time. Also shown were some *B. liniflora* that were much smaller. To complete the display, there were numerous plants of *Dionaea muscipula* which were in flower.

Perhaps the most interesting point about the display was that all species were receiving exactly the same conditions with regard to light, heat, water, etc., and as far as I could see, German peat moss was the sole item used as a potting medium. All species were well labeled, and a reasonable amount of information was displayed about CPs in general. I will be visiting Kings Park regularly to watch the plants mature, and I will be very interested to see how all grow together, bearing in mind that, generally we would grow some of these species differently from others in the collection.

In closing, I would certainly recommend that anybody visiting Perth, Western Australia would see the display at Kings Park, particularly as it is so close to the city center.

JOHN HUMMER (Insectivorous Gardens, 1705 N. Quebec St., Arlington, VA 22207) writes: I would like to report on some observations I've made on the multitude of *S. rubra* ssp. *wherryi* that I have grown in my backyard over the last 5 years. During this time, I have been sent several shipments of this species from two different sources, coming from different locations where this species grows. Having a lack of knowledge of field work on just where one encounters this species, I've had to rely on the knowledge of an associate, Phil Sheridan, who has seen many of these plants growing in southern Alabama. According to his observations, the species, or subspecies *S. rubra wherryi,* exhibits two distinct forms in morphology. To understand my wonder into this observation I must go back about three years, when I was sent what was supposed to be *S. rubra* ssp. *alabamensis* from an associate of mine, Bruce Bednar. He had stated at the time that all the plants at the locale he had collected the specimen from were obviously *S. alata,* but that this plant had *RED* flowers. This was confirmed to me about two years later, when the plant produced at least five, possibly 6 flowers. This mature plant, at the

time, exhibited *none* of the characteristics that my other forms of *S. rubra* ssp. *wherryi* had shown, that is, the *expanded* upper column and the *prominent* undulated hood. What they did resemble was the pubescent form of *S. alata.* A short pitcher, mainly olive-green with red venation (not prominent), but otherwise none of the characteristics in the most recent general literature. This characteristic occurs throughout the entire growing season, and not just early spring or summer. Last spring I was sent a shipment of plants labeled *S. rubra* ssp. *wherryi,* from Mr. Bob Hanrahan which I didn't question in the least as being 'authentic'. Yet, during last year's growing season and this year's, the plants (about 50 or so in numbers) failed to produce anything approaching the descriptions in the most reliable literature (i.e., mature pitcher producing the expanding upper column and the marked undulated hood). I would like to point out, also, that both forms of the plants have been grown in like, or very similar, habitats. It is also interesting to note that the plants of the more "knowledgeable forms" maintained their more robust characteristics (expanded column and undulated hood) when grown under less characteristic conditions of their habitat (dryer and well-drained environment). At least, *under my authority they did.* As a result, with the help and advice of my associate, Phil Sheridan, I have been able to determine that there appears to be two distinct forms of *S. rubra wherryi* or ssp. *wherryi.* I have more than 50 plants of both forms and have been growing both near each other for several years. The differences between the two, for me, are too obvious to be ignored—by even the most conservative observer or botanist! Clearly, they're two different forms! One might surmise that these plants resembling the described *'Alata'* form are not actually hybrid forms of a cross with *that* plant. (Possibly, but the flowers of the plants are all *rubra* like and show no introgessed tendencies; that is, mixed flower color, intermediate leaf forms, etc.) Mr. Sheridan, who has been in the field location of *S. rubra* ssp. *wherryi* on both sides of the Mobile River, has further confirmed my wonder by stating that plants on the WEST side of the Mobile River assume the characteristics of the *S. alata* pubescent from, and on the *EAST* side, the literary form (i.e., the expanded upper column and undulated hood *BOTH PROMINENT*), the latter totally lacking in the 'westside' plants. Anyone who has further knowledge or is able to substantiate a challenge to this find is welcomed!

JOHN HUMMER also writes: As reported in the latest issue of *Nature Conservancy News,* of prime interest to all us lovers of *Sarracenia* is the organization's 'New Project' acquisitions for the near future. Chitwood Bog Dekalb Co. Ala., noteworthy for its thriving colony of green pitcher plants (*S. oreophila*), federally listed as endangered, this small seepage bog is a new Conservancy Project. Purchase of 53 acres safeguards the site, identified some years ago in the federal "recovery plan" for the plant. Chitwood is slated for management-under-lease to the U.S. Fish and Wildlife Service.

JOE MAZRIMAS reports that there is a Venus'-fly-trap look-alike coin bank available. When you put a coin on top of the plastic "flower," it opens and swallows it! With batteries, this "coin-ivorous" toy costs $18.36 (includes postage) and is available from: The Whole Mirth Catalog, 1034 Page St., San Francisco, CA 97117.

CURTIS YAX (233 Chestnut St., Oneonta, NY 13820) writes: I was very disturbed to read THE ALBANY AREA, *CPN* 14(3): 74-76. *CPN* readers should be concerned with conservation and not the destruction of CPs and the wildlife that live near them.

Mr. Mann shows no respect for wildlife by shooting a snake which he could have easily walked away from, but instead, took the time to aim at and kill. Let's not go out and kill every living thing because of our delightful hobby. Instead, let us be good examples for others!

Q & A

QUESTION: Bruce Pierson (P.O. Box 179, Albion Park, NSW 2527, Australia) has written in concerning an answer to a question regarding one possible mechanism of acquired pubescence (fine hariness of the pitcher outer surface) in variants of *Sarracenia* (CPN 14:50-51). He has a plant of *Sarracenia leucophylla* which is pubescent and has enclosed a picture of the upper portions of some pitchers. He is wondering if this necessarily represents a kind of introgressive macrorecombination with *S. purpurea* as suggested in my answer in the June issue. He also suggests that species of *Sarracenia* other than *S. purpurea* may be pubescent and that possibly his *S. leucophylla* may be a legitimate genetic entity.

ANSWER: First, my answer to the question in the June issue included a "most likely," indicating that we are indeed dealing with a complex situation when considering variations in *Sarracenia*, especially among species that commonly grow together closely in huge bogs such as along the Gulf Coast area of the United States. *S. purpurea* is certainly not the only pubescent species of *Sarracenia*, the various subspecies of *S. rubra* being prominent examples, although they are more finely pubescent than *S. purpurea* ssp. *venosa*. These may also be involved in complex backcrossing of only a few or even single characters back into what appears to be mainly one of the parent species of the putative hybrid.

Looking at your color print of the upper pitcher portions, the pitchers appear to be either etiolated or early or late pitchers with prominent ala and relatively narrow tubes at the mouth. "Pure" (note the quotes!) *S. leucophylla* has a much wider mouth than in your photos. Also, the shape of the lid and the venation type would suggest to me that this is indeed a possible complex back hybrid. Just on intuition, I would judge more of an *S. purpurea* influence than *S. rubra*. One must also be cautious of trying to determine hybrid parentage of *Sarracenia* with only a few examples of seedlings from the many seeds produced by selfing. Our Japanese friends in particular have shown that such hybrid selfing produces a majority of plants more similar to the original hybrid in appearance, although a few plants closer to either parent may also appear. Most of us who have done this concur.

Your question is quite useful as an encouragement to all of us to research this genus much more. For those who wish to acquire some general botanical references on plant variation, its causes and nature and genetics, and plant evolution (when does "it" become a species??), I can recommend the following two books in particular as a beginning. They are both available from the publisher in paperback. The authors do presume some basic background in botany and genetics.

Briggs, D. and S.M. Walters. 1984. Plant variation and evolution. Cambridge University Press (in Australia, 296 Beaconsfield Parade, Middle Park, Melbourne 3206). 412 p.

Grant, V. 1981. Plant speciation. Columbia University Press, New York, 563 p.

DES

PHOTO CREDITS

- Corrections -

CPN 14(2): 43 - Photos were taken by David Ainley.

CPN 14(4): back cover - Photo was taken by Joe Mazrimas.

Pardon our errors, please!

(Third article of series relating to old CPN *articles)*

(REMINISCENCES - III) CPN AND CONSERVATION

by Donald Schnell

About a year ago, I received a letter from a writer who stated she was about to publish an article in a magazine concerning recent plant conservation measures, and in the letter she expressed her displeasure with CPN for not having expressed a conservation attitude, and she further stated that she was about to say so in her article. True to her word, the article was published and there was a line or two about CPN and how we did little for conservation.

Several years ago, I received a series of letters from a young man who was also beginning a newsletter in connection with his fledgling CP sales nursery. Both are now defunct, but he expressed concern that the editors of CPN had never expressed "an editorial policy," particularly one toward conservation. To this day, I am not certain what sort of "editorial policy" he had in mind otherwise. I thought we had always made it pretty clear what CPN was about, basically a central exchange of CP communications available to any subscriber. CPN was never intended as a crusade.

However, early on we did in fact realize that there were some responsibilites we as editors and you as serious CP enthusiasts should consider regarding conservation of CP. Contrary to the preceding two paragraphs and a few other communications of similar tone, there has in reality been a steady stream of conservation comment of a positive nature in CPN from early on. The workability of some of the conservation proposals from a practical view has been quite variable, but all well intended and deserving of consideration. Actually, out in the world over a long term basis, little else seemed to be working right to really conserve CP habitats, so maybe it has been time for some fresh thinking that admittedly might be an anathema to those who stubbornly persist in what are often cliche concepts that have worked little for other areas, let alone being applicable for CP.

I guess different readers will look at this article in different ways, perhaps some of you feeling that we are being a bit defensive. If nothing else, look at it as a review of what has been said about conserving CP by both readers and editors of CPN.

Positive comments about conservation of particular species, locations or CP in general appeared as portions of various articles early in CPN (See Vol. 2, pp. 4, 10, 33-34, 36-37, 56; Vol. 3, pp. 7, 26, 48-49, 51; Vol. 4, pp. 27-28). In a brief editorial response to your responses to a questionnaire of readers, we stated a policy of conservation from the editor's viewpoint in Vol. 4, p. 29 in which we strongly urged the propagation of CP either vegetatively or by seed so that those wishing plants to grow could obtain them by trading for or purchasing propagated material rather than increasing harvesting from the field. We further stated that we would leave publication of maps and location details up to the submitting author.

Looking back, I can see that the last sentence of the preceding paragraph might have been stronger in perhaps refusing at that time (we later did) to print any detailed location maps or descriptions beyond which might be necessary to make an ecologic point. I guess we were too innocent then.

In Vol. 4, p. 49, David Lane briefly summarized the CP aspects of the first attempted listing of endangered plants in the Federal Register, and efforts by the new CITES organization to begin evaluating the situation. To many of us in the field in our own areas, the problem had been obvious for years, the solutions far more difficult and

to this day elusive in spite of good intentions. In the same issue of CPN in which the above appeared, I commented (p. 42) that habitat destruction was the primary culprit, and to this day this is accepted to be so. I also acknowledged that predation of rare taxa of CP growing in small numbers in a location was also a serious problem (e.g., *S. oreophila*). I then described my personal observation in the Green Swamp area of North Carolina in which on one summer afternoon several people were collecting *masses* of *Dionaea, Drosera* and *Pinguicula* and placing these in a *large dump truck* along with some sphagnum. They blithely went about their work, glancing up at me now and then, knowing I was watching. Ironically, the area from which they so heavily collected to my indignation is now drained, dry and the site of young trees growing in neat rows with no hint of CP between them. At that point in this 1975 commentary, I expressed the view that eventually many of our CP species would find their last refuges in well-grown greenhouses, botanical gardens and a few preserves that could be secured.

In Vol. 5, pp. 3-4, we finally printed a lengthy editorial on our feelings concerning CPN's responsibility to conservation. Some readers had felt that the very existence of CPN had fanned such interest that we had incited rampant bacchanals of collecting from the field, and that in our annual list of CP commercial suppliers were listed companies which readers felt collected from the field. We stated our personal concern for conservation. We also announced that ensuing plant supplier lists (which were always published as a service to readers and never endorsed by us) would have those dealers who guaranteed that they sold only propagated material so marked. We also stated our primary concern for massive, mechanized habitat destruction as the primary problem in conservation. Finally, we supported legitimate "plant rescue" projects, such as those undertaken with regularity by the NC Botanical Garden. Such rescue operations should only be undertaken if site destruction is assured and imminent, and if translocation plans for the plants are reasonable. The Garden has handled this responsibly. Purists argue that translocation measures and propagation in botanical gardens, greenhouses and private collections are not the final answer. None of us say it is. The only reasonable approach can be preservation and security of large land tracts. But we saw—and still see—why clearly doomed plants of a specific site should not simply be bulldozed if they can be translocated for various legitimate purposes.

I think by now you get the point that we feel that we have given conservation its mention and our support over the years. My documentation stops at Vol. 5 above, but various brief and longer discussions of the problem occur in later issues as well at about the same frequency, and I will not bore you by listing more of them; they are there.

In the meantime, what has been accomplished? More commercial suppliers are propagating now, although some still do some collecting. The US Fish and Wildlife Service is sluggishly plodding in the deep muck of lack of personnel, lack of funds and lack of political interest, so the Federal Endangered Species Acts are having variable effects at best. CITES enforcement twitches now and then, but botanically inexperienced port inspectors are asked to identify plant material on the basis of line drawings and descriptions, and could they really tell an *S. oreophila* (protected, and maybe used as a labeling cover by the unscrupulous) on the basis of those pretty drawings, the descriptions and their lack of experience and real interest?

In the United States, government activity is at best inefficient. True, our wilderness areas have recently been expanded, and there are laws about taking plant material from local, state or national government lands (this while lumber companies sheer and crush square miles of national forest yearly). But the laws are unenforceable for many obvious practical reasons. We always seem to get back to this business of practicality—reality versus pronouncements and dreams.

I think the best hope for any specific land tract conservation effort (which, as you know, is what I believe to be the best effort to

EDITOR'S CORNER *by Don Schnell*

(Reprinted from *CPN* 11(1): 3)

Carnivorous Plant Newsletter is now entering its eleventh year, and those who have been with us all the way or at least for a greater part of those ten previous years have watched this publication grow from a small offset looseleaf format to our present fine journal with wide-ranging articles and features serving many interests worldwide. CPN is widely respected, is now being carried by more libraries, and even crops up now and then in formal journal or book bibliographies.

One of the most popular services we offer is the CPN Seed Bank, which is quite capably and generously run by Patrick Dwyer. Patrick receives no remuneration for his efforts and gives time from a very busy schedule to keep things running smoothly. It does not take much imagination to realize that the Seed Bank operation is not at all an easy matter, but Patrick has welded order and promptness out of this most difficult challenge.

The Seed Bank belongs to every ICPS member, of course. Obviously, the seeds must come from somewhere, from members who are willing to take the time to carefully pollinate and then collect seed. For donating seed, the member receives at least two rewards: credits for drawing seed from the Seed Bank at no charge, and the satisfaction of his contribution to CPN and other members.

The seventy-five cents per packet charge for seeds requested by non-contributors is fair and appropriate. It helps cover Patrick's cost for containers, wrapping and mailing. Any money in excess of that required by Patrick for expenses is turned over to CPN and used to cover the costs of printing and mailing. Last year, there was sufficient money from the Seed Bank alone to cover the text printing costs of nearly one whole issue.

The unrelenting rise in printing and postage costs has been your editors' most nettling problem these past years, and we anticipate no less of a problem for the forseeable future. This year we are able to hold membership fees to last year's level by increasing efficiency of operations, and by anticipating Seed Bank returns. No small journal of this kind can exist for long on membership dues alone, for it would soon price itself out of the market.

So, help yourself out as a member who wants this journal to remain at its high level and to grow still more in order to best serve your purpose. Set aside a few minutes to produce seed from your plants to donate to the CPN Seed Bank. The Seed Bank needs a constant influx of increasingly varied material to continue to be a service to all of you.

Continuation of REMINISCENCES from page 7

save any species or stand of plants) seems to be in the private sector where Nature Conservancy and, on a smaller scale, the National Audubon Society have recently made some truly fine coups in saving land sites of all sizes and kinds throughout the country. Skillfully operated by business-wise leaders and supported by thousands of private individual members (of which I am one) and many large corporate members as well, the Nature Conservancy in particular has often beat developers at their own game and saved critical habitats that would have been doomed. Now we are talking nose-to-nose, across-the-line reality. The tracts are acquired through either donation or purchase, and then managed by local chapters until other suitable arrangements guaranteeing security can be made.

In the meantime, the co-editors of CPN, the publisher of CPN, and we believe the vast majority of our subscribers do indeed support conservation efforts and will continue to do so.

SEED BANK

Patrick Dwyer (St. Michael's Episcopal Church,
49 Killean Park, Albany, NY 12205)

To send seed: Please remove seed from the seed capsules and place it in small envelopes (preferably paper so that they dry out enough to prevent mold). Label with the origin and date of collection, including habitat if it is exotic. Fold the envelope once or twice before taping so that the seeds don't stick to the tape. After the seed is received it will be placed in smaller packets; donors will be informed of how many packets they have donated. A donation of 10-19 packets earns one free seed packet of comparable rarity, with one additional free packet for each additional 10 packets.

Do not ask to trade for seed from the bank. Everyone will have to buy all but the free packets.

To order seed: Please enclose payment. List the seeds desired and an equal number of substitutes in order of preference. If requested, Patrick will add any cultural instructions of which he is aware. Each issue of CPN will include an update of the inventory. Cost per packet: $.75. (Number of packets is listed if less than 15 are available.)

Darlingtonia californica; Drosera aliciae, D. auriculata, D. binata, D. binata (New Zealand), *D. brevifolia* (2), *D. burkeana* (3), *D. burmannii, D. capensis, D. capensis* (Warron), *D. capensis* (mix), *D. capillaris, D. dielsiana, D. erythrorhiza, D. filiformis filiformis, D. filiformis trachi, D. filiformis filiformis × filiformis trachi, D. glanduligera, D. indica, D. intermedia, D. macrantha, D. macrophylla, D. montana, D. natalensis* (6), *D. nitidula* (4), *D. peltata, D. planchonii* (15), *D. pulchella* (6), *D. pygmea, D. rotundifolia, D. spathulata* (Formosa) (6), *D. spath. (Kansai), D. spath.* (Kanto) (6), *D. spath.* (Tanega) (3), *D. spath.* (white fl.), *D. stolonifera, D. villosa* (4), *D. whittakeri* (14); *Drosophyllum lusitanicum* (10); *Nepenthes albo marginata; Pinguicula alpina* (14), *P. grandiflora rosea* (13), *P. vulgaris* bicolor (5); *Pollypompholyx multifida* (6); *Sarracenia alata, S. flava, S. flava* (copper lid) (10), *S. flava rugelli* (3), *S. flava* (red tube) (2), *S. flava* (mixed var.) (5), *S. leucophylla, S. leucophylla* (tall thin) (2), *S. psittacina* (giant) (8), *S. purpurea purpurea, S. purpurea* (NJ-MD), *S. purpurea* (Gulf Coast), *S. rubra* (Gulf) (3), *S. rubra jonesii* (4), *S. rubra jonesii* (new hybrid) (2), *S. rubra wherryi* (10); *Sarracenia* Hybrids; Small Quantities (1-10 packets); *Rubra gulfensis × leuco, alata × purp., leuco ×* red *alata, leuco ×* green *alata, psitt. × oreo, psitt. × rubra wherryi, oreo × alata, flava × leuco, leuco × minor, leuco × rubra wherryi, psitt./purp. × rubra, minor × leuco/flava, flava × leuco/purp., leuco/minor × rubra, purp. (gulf × leuco) flava, leuco/purp. psitt./purp. × minor, psitt./purp. × minor × minor, psitt./purp. × rubra × leuco/minor, psitt./minor × oreo/alata × leuco, leuco/minor × psitt./purp. × rubra, psitt./rubra × leuco × psitt./purp. × minor purp./rubra × minor;* Larger Quantities (10 or more packets); *leuco. × purp., flava × leuco.* (Gulf), *alata × minor, rubra* (Gulf) *× psitt., leuco. × minor, psitt./purp. × rubra, psitt./purp. × minor, oreo/psitt. × leuco, rubra* (Gulf)*/leuco × leuco/minor, psitt./leuco × oreo/psitt.,* red *alata × oreo/alata, psitt./purp. × leuco/minor, purp./psitt. × minor × alata/minor, psitt./purp. × rubra × oreo/alata, psitt./purp. × minor × psitt./rubra × leuco, psitt./purp. × minor × psitt./minor × oreo/alata.*

DROSERA PETIOLARIS THE WOOLY SUNDEW

by Curtis Yax (233 Chestnut St., Oneonta, NY 13820)

Drosera petiolaris, or the wooly sundew, as it is commonly called, is a very handsome CP making its home in tropical Northern Australia and New Guinea. The plant grows near lush rainforests in sandy and acid soil. There are several beautiful sundews which also inhabit these woodlands, but *D. petiolaris* is the oddest looking plant of them all.

Looking somewhat like a wheel spoke with little suns at the tips, it is a very hairy rosette. This rosette spreads up to 5 inches across with numerous layers of young and old dead leaves which hug the ground underneath. The leaf stalks vary in size and even in color. Some forms of *D. petiolaris* have wide stalks while others are very narrow like *D. intermedia.* These range in size from tiny 0.5 inch petioles to large ones measuring several inches. The color varies from a deep dark green to a bright red and even purplish hue. The leaves either grow into the air or prostrate themselves onto the wet ground.

The wooly flower is very attractive and large. There are abundant flowers being supported on an arching 10 inch scape which is also hairy and rather thick. Often, more than one flower scape appears per plant. In the terrarium with artificial light, the flowers produced no seed either using self-pollination or with my lending hand. Other growers whom I correspond with report no luck either in producing the precious seed. They grow their plants in greenhouses, terrariums and even outdoors. If someone knows the secret, please let us know! Though seed production is a problem, the flowers are as pretty as a Renoir painting, being dark pink or white with bright yellow-orange pollen heads protruding in the middle of the flower.

The best method of propagation is division of the rhizomes when the plant forms clumps of two or three large plants. My plants usually grow two new plants on the sides of the parent plant. These grow vigorously and very fast, but without traps. The plant is using much of its energy to produce new roots and young growth. When the young plants are divided, they return to producing traps.

Lifting the wooly up with its ball of soil around the roots, place the plant on your worktable. Gently, remove the soil from the roots by dipping into a bowl of rain water. While you're working on the plant, make sure roots do not dry out completely. To prevent drying out, keep dipping the roots in the bowl of rainwater often. When a plant is disconnected from the parent plant, place the roots gently into the rainwater leaving the plant on the rim of the bowl. Be careful not to get the fresh cut foliage too wet or rot will set in. Now, when you look at your plant, you will see that the three or more different growths are tightly connected. They are bulberous with many fragile, blackish-pinkish roots. It's alright to cut some leaves off near each connection to get a better view of individual plants. With clean scissors, cut off completely one plant with a few roots attached. Make sure that you have at least one good, long root remaining intact. Continue to divide until the clump is free of attachments. Now, place the individual plants back into the terrarium or pot, leaving room enough for a 6-inch spread. Within a month, the new plants will be growing vigorously, and you can clip off all undesirable and deformed leaves letting the normal ones fill the scene.

This process of dividing can be repeated often for *D. petiolaris* and the excess plants can be given away, traded or sold. This species is new to cultivation and I'm sure that most CP growers would love one. This helps conservation and eases the collecting

D. petiolaris, hairy form. Photo by Joe Mazrimas

of wild specimens. I advocate trading plants with each other to acquire the various unique forms.

Cultivating this plant is simple if one respects the following growing conditions. Mine grow in 3 inches of Canadian peat moss with a 2 inch layer of dead sphagnum moss on the bottom for the roots to penetrate. I keep the soil fairly damp but not sopping wet. I seldom water them, for they grow nicely in a terrarium which retains the right moisture. I use rainwater only, or mineral spring water, which is used to flush out salt build-up around the plants. I don't know of any specific disease which could affect the wooly, but one should watch out for pests by using pieces of peststrip in the vicinity of the plants. The temperature around my plants is warm, around 65°-70°F in winter and 75°-100°F or higher in the summer. A warm, contrasting temperature all year is good for the plant.

If one uses artificial lighting, place the plants about 10 inches from the lamps using one bulb of Gro-lux type and one cool-white bulb. This combination gives off a full spectrum of light for healthy, new growth and many blooms. The lights should be switched on for a 16-hour day throughout the year, for there is no dormancy period. I keep the humidity high with the glass cover slightly opened to provide adequate ventilation.

D. petiolaris eat the smallest of prey, fruitflies and other tiny insects. One can feed them by hand some minute bits of dried Tubiflex worms but it's best to not overdo it by feeding them one trap per plant per week. The leaf blade, or its tentacles, show little movement in response to food which is so obvious in other *Drosera* like *D. capensis* or *D. prolifera.*

This wonderful, delightful plant species is one of God's most handsome of all the sundews which is rarely written about but certainly deserves attention. The name, "sundew," fits perfectly—with its little "suns" waiting patiently for the next meal!

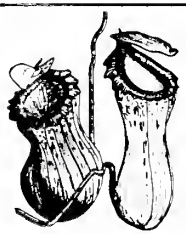
Carnivorous Plant Culture in Holland

by Larry Mellichamp

I have just learned in detail about an amazing operation in Holland at a nursery called Cresco. There they have over 50,000 sq. feet of greenhouse space devoted exclusively to propagating carnivorous plants which are sold wholesale to mostly European and Asian buyers. They are generally interested in propagating CP from seed and cuttings; but Venus' Flytraps, *Cephalotus*, and 15 varieties of *Sarracenia* are propagated by tissue culture.

The person in charge of this enormous effort is Mr. T. deGroot. He visited the US in March, 1985 and spent the day with me at UNCC looking at my CP collection and describing his interests in commercial propagation. Mr. deGroot says that he can supply the world with propagated CP, and that he would like to see an end to exporting collected (from the wild) CP. For example, millions of Venus Flytraps are dug every year and shipped to Holland and Europe (he has even bought them to keep them from going to other nurseries who only want to quickly resell them). Mr. deGroot is interested in selling only propagated plants. Right now he has some 2 million Venus Flytraps growing in his greenhouses, of which about 1.5 million are from leaf cuttings, and ½ million are from seed. He roots the leaf cuttings on a moist absorbent felt-like fabric mat, just lying on an open bench. After rooting, they are planted in a peat mix. He says he can grow better plants than those grown from collected bulbs; and soon he will be able to propagate them cheaper than digging them!

Mr. deGroot has apparently done an outstanding job of mass production of *Sarracenia* species and hybrids also. As the photos show, he has thousands of specimens grown from seed or leaf cuttings. He says they are easy to root from leaf



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cuttings if a piece of the rhizome (stem) is attached. *Sarracenia psittacina* is the easiest to root from cuttings in this way, but others work, too. The rooting takes place without the application of hormones, and the resulting plants are grown entirely without fertilizers. Mr. deGroot feels that he has achieved an ideal growing environment for the plants and evidence for this is that *Utricularia,* which are not purposely grown, frequently appear and thrive in pots of other CP.

Mr. deGroot is currently interested in increasing his collection of "mother plants" as he calls them, the stock plants from which seeds and cuttings may be taken. Thus, year by year, more propagules may be obtained so that enormous numbers of saleable specimens can be routinely produced. And these are beautiful specimens! The fact that they have spent their entire lives in a greenhouse under controlled conditions may be a factor in making them better plants for the public rather than wild dug plants that have been through the shock of digging, transport, re-establishment in a new environment, and then sold. Currently, Mr. deGroot has some 2,500 large *Darlingtonia* which have provided material to produce 25,000 small propagated plants. After several years of building up stock, many thousands of plants can be produced that would have otherwise been collected from the wild. I personally believe, from my own experience, that propagated plants are easier to maintain than collected plants of *Darlingtonia.* Mr. deGroot says that most of the *Darlingtonia* offered for sale now are collected plants. Think about this: if we allow today's collected plants to be used as stock plants for tomorrow's propagated specimens, it would be a small price to pay for future security.

It was fascinating to see the photos Mr. deGroot showed me of enormous beds of *Sarracenia purpurea, S. leucophylla, S. rubra,* and several interesting hybrids. Recently at wholesale trade shows in Holland, Cresco has set up an exhibit of CP to show the beauty and uniqueness of these plants. By distributing colorful brochures and posters, and by allowing the public to view these trade exhibits, interest is being drawn to CP. We are thus on the verge of a dilemma. If we generate interest in CP, we must be able to supply the demand for plants. These plants can come either from wild collected specimens, or from propagated plants. It could be devastating for us if more and more *Sarracenia* are being collected from the Southeast to be shipped to nurseries in England, Holland, Germany, and Australia to meet the demand for such plants. We should encourage nurseries like Cresco, and dedicated professionals like Mr. deGroot, to begin NOW to propagate large quantities of plants to meet future demands. Even if nurseries grow wild-collected plants taken from habitats that are being destroyed, the plants are still inferior to propagated plants. Besides, we should all be wholeheartedly against the massive destruction of wetland habitats in the Southeast where uncountable thousands of plants are lost each year. Even in the US, some of the people who dig plants for a living could begin NOW to learn to propagate for a living, and export propagated plants instead of dug ones. Now it is cheaper to dig; but what about a decade from now, with dwindling supplies of wild plants?

Let me close by emphasizing that Mr. deGroot's plants are not available to retail customers; they are probably not even available in the United States. If US growers are worried about the competition, it is competition outside the US (as with foreign cars). It would be good if there were more people in the US interested in buying other CP than just Venus Flytraps at their local store. With a little special knowledge, *Sarracenia* and *Drosera* can be grown as easily as tropical orchids, bromeliads, ferns, and peperomias that require a little extra care.

Above all, along with stimulating interest, the ultimate idea is to encourage propagation of CP so that people can enjoy them without sacrificing so many wild plants. **(Please see photos on pages 14, 15 and 18.)**

Mass production of *Sarracenia purpurea* at Cresco nursery in Holland.

Sample of Mr. deGroot's some 2 million Venus Flytraps growing in his greenhouses.

Solid *Sarracenia psittacina,* from leaf cuttings, grown in Mr. deGroot's nursery without application of hormones or fertilizers.

Mr. deGroot, holding *Darlingtonia,* in his Holland nursery. Some 2,500 large *Darlingtonia* have provided material to produce 25,000 small propagated plants.

Action Potentials in the Venus Fly Trap

by Gregory T. Shanos, B.A., B.S., R.Ph.
160 Budlong Avenue, Warwick, RI 02888

The Venus Flytrap, *Dionaea muscipula* Ellis, is endemic to North and South Carolina, extending a 60-75 mile radius around Wilmington, N.C. (Schnell 1976; Schwartz 1974). The plant consists of a rosette of leaves emanating from a central rhizome. The leaves consist of a narrow to broad leaflike petiole near the rosette center with a leaf blade modified into a unique trap (Lloyd 1942; Schnell 1976). The trap is bilaterally symmetrical with the two lobes separated by an angle of approximately 45-60 degrees (Benolken, *et al* 1970; Lloyd 1942; Schnell 1976). Each lobe contains three or more trigger hairs placed in a triangular position (Darwin 1875; Lloyd 1942; Schnell 1976; Slack 1979; Benolken, *et al* 1970).

The sensory hair is 2mm in length and 200 microns in diameter. The fine structure of the trigger hair consists of two distinct sections. The outer cone of thick-walled cells is called the lever and the 4-5 courses of cells joining the trap surface on which the lever sits, the podium (Lloyd 1942; Williams, *et al* 1971). These4-5 courses of cells are termed, "the indentation," by Williams, and "sensitive cells," by Lloyd.

The closing response, whether initiated by mechanical, chemical, electrical or thermal stimulation of the trigger hairs, results in the production of action potentials. A minimal requirement for closure is that one sensory hair be mechanically stimulated twice or two different hairs be stimulated simultaneously (Balotin, *et al* 1962; Brown 1910; Brown, *et al* 1916; Darwin 1875; Jacobson 1965; Lloyd 1942; Schnell 1976; Schwartz 1974; Slack 1979). At higher temperatures, i.e. thermal stimulation, the trap responds to one stimulus if the hair is bent (Brown 1910). Closure can also be induced chemically with 3% saline as investigated by Balotin, *et al* 1962.

The existence of action potentials upon stimulation of the sensitive trigger hairs has been investigated and confirmed by various authors. Shuhlman O., Jr. and Darden, E.B. 1950, observed a diphasic action potential consisting of a short-lived positive electrical increase followed by a larger negative rise and fall in potential. A positive after potential follows with restoration occuring within 1.5 seconds.

DiPalma, J.R. 1961, determined that two successive stimuli are necessary to cause contraction. The first action potential was ineffective and elicited a slower depolarization rate than the second action potential which resulted in trap closure. Quantitatively, the duration of the negative phase was experimentally determined to be 0.13 seconds as compared to the first action potential of 0.24 seconds. Apparently for the excitatory process to initiate contraction, the rate of depolarization must attain a certain velocity. Buchen, B. *et al* 1983, quantified this velocity to be 20 cm/second.

The plasmalemma resting potential was recently determined to be -80mV. This resting potential is subsequently depolarized to a graded, non-propagated receptor potential, followed by an action potential of about +80mV which propagates to the motor cells with a velocity of 20 cm/sec. Alterations of the membrane potential may be mediated by differential gradients which lead to turgor changes and ultimately trap closure (Buchen, B., *et al* 1983). Morphologically, the apical and basal cell poles of the sensory cells in the trigger hairs of the Venus Flytrap are structurally identical. A complex of concentrically arranged endoplasmic reticulum cristernae occupies each of the poles. One to four vacoules are enclosed within the central cisterna and contain polyphenols. The role of these polyphenolic compounds in the sensory cells can be considered as storage, binding, and release of ions which are necessary for the electrochemical processing of stimulus transduction (Buchen, B., *et al* 1983).

Balton, M.N. and DiPalma, J.R. 1962, in-

vestigated that both mechanical and chemical stimulation of the trigger hairs results in the production of action potentials with subequent trap closure. Mechanical stimulation of the trigger hairs results in a single action potential. The instillation of 4 to 6 drops of 3 percent sodium chloride solution in the leaf trap of *Dionaea muscipula* results in a series of spontaneous action potentials and trap closure. The action potentials were highly variable with respect to frequency and duration. An amplitude of 20-30 mV with a 2 to 4 second duration was observed. The pulse frequency of the action potentials were 2 to 4 pulses per minute with a total duration of one minute to several hours. Variations seen in the action potentials were due to positioning of the electrodes, health, age of plant, temperature, and intensity of stimulus. The mechanism of closure is believed to be linked to a positive loss of turgor in the leaf trap upon stimulation of the sensitive hairs. This results in the sudden reduction in hydrostatic presssure of the cells of the inner epidermis through depolarization.

Affolter, J.M. and Olivo, R.F. 1974, observed the presence of long term action potentials following the capture of prey. The investigators placed a live Isopodia (pill bug) inside the trap and monitored the action potentials for the first two hours. Over one hundred sporadic action potentials were recorded from this trap as a result of repeated stimulation of the trigger hairs by the struggling prey. Evidently the prey is not necessarily killed immediately after it has been trapped. Repeated stimulation of the trigger hairs by the active prey therefore results in action potentials thus causing the trap to tighten further. These continued action potentials also stimulate the digestive glands of the plant to begin secretion. The juices expressed by the compression of the leaf, or exuded during the struggle, have an effect similar to 3% saline. The juices of a leaf that contained an insect for 48 hours will, if instilled on another leaf, cause spontaneous electrical activity and subsequent closure of the trap.

DiPalma, *et al* 1966, investigated numerous small structures (stellate trichomes) protruding from the surface of marginal hairs, outer leaf surface and stem of *Dionaea muscipula.* None of these structures is present inside the trap nor among the trigger hairs. Mechanical stimulation of the stellate trichomes results in the production of small action potentials and eventual closure of the trap, independent of the sensitive trigger hairs. Stellate trichomes are microscopic and at a magnification of 100x they resemble small rosettes. There are generally eight hair-like petals of non-cellular translucent material radiating from a central spindle, with an overall diameter of 80 microns. Subthreshold stimulation of these structures appears to sensitize the trigger hairs and facilitate closure of the trap. Approximately 8 to 10 strokes of a brush across the outer surface to the trap elicited the first action potential, after which a small non-propagated potential arose after each stroke. The trap contracted when 5 or 6 full action potentials were propagated by the stellate trichomes.

The stellate trichomes may therefore serve as touch receptors that are capable of altering the internal environment of the trap thus rendering it more susceptible to closure by deflection of the trigger hairs.

The Venus Flytrap, "the most wonderful plant in the world," is truly a marvel of nature. Its unique ability of producing action potentials and digestion of insects, with subsequent absorption of nutrients, has indeed fascinated man for centuries.

Note: *The author invites you to contact him if you wish to read any of the cited literature.*

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1. Affolter, J.M. and Olivo, R.F. 1975. *Action potentials in long term observations following the capture of prey.* Amer. Midland Naturalist 93: 443-445.
2. Balotin, N.M. and DiPalma, J.R. 1963. *Spontaneous electrical activity of* Dionaea muscipula. Science 138: 1338-1339.
3. Benolken, R.M. and Jacobson, S.L. 1970. *Response properties of a sensory hair excised from Venus's Flytrap.* J. Gen. Physiol. 56: 64-82.

(Turn to page 26.)

Byblis gigantea, 7 months old, grown from seed. Grown in full sun with many dead flies on the plant. Photo by Bob Dixon.

Exhibit of CPs set up by Cresco at a wholesale trade show in Holland.

RAINBOW PLANT

Bob Dixon
Horticultural Advisory Officer
Kings Park and Botanic Garden
West Perth Western Australia 6005

Byblis gigantea, the Rainbow Plant, is one of only 2 species contained within the genus *Byblis*. Both species occur naturally in Western Australia, *B. liniflora* grows in the north of the state, also in the Northern Territory and Queensland, whilst *B. gigantea* occurs nowhere else except the south west of Western Australia. Its main area of distribution is from Eneabba ca. 280 km north of Perth where it grows on heaths in dry, sandy to sandy, lateritic soils, to just south of Perth in sandy, winter wet areas. These are often referred to as swamps, but they are not boggy (there is no surface water around the plants), and they dry out rapidly in early summer.

In its natural habitat it can flower from early October through January. After seed production in January-February the plant goes into senescence. New growth starts again from the old woody plant or rootstock after the start of heavy, late autumn rains.

Perth's climate is classified as Mediterranean with long, hot, dry summers and cool, wet winters, with an average rainfall of 873 mm.

PROPAGATION

Plants can easily be raised by taking etiolated cuttings, that is, a shoot which has a portion a few centimetres long which has been below ground level. These cuttings strike readily in a few weeks. Unfortunately, this method of propagation is rather destructive to the parent plants which have few shoots; therefore, propagation by seed is recommended.

SEED

Each seed capsule produces numerous (often over 50), viable small black seed, which are deeply pitted with a firm but brittle seed coat. Although it is usually recommended to pour boiling water over the seed to stimulate germination, I find it germinates just as well without this treatment.

In Western Australia the seed can be sown straight after harvest, left dry, then watered in the autumn or sown in the autumn. I sow the seed on top of a mixture of 6 parts local, grey bush sand (a medium grained sand), 1 part local peat (a sedge type of peat) parts by bulk. The seed are then covered by a thin layer of blue metal dust (crushed granite) 2-3 mm grist; alternatively, seed can be sown on top of this covering as it will be washed between it.

In my garden I leave the seed pots out in the elements, i.e., full sun, wind and rain, and start watering the seed in April. I often have to water every day as the seed pots dry out quickly at this time of year. Germination takes about 4 weeks. Due to the number of frogs I have in my garden, (I assume it's the frogs which carry the seed about on their feet) the seedlings more often than not come up as thickly in adjacent seed pots. Germination rates are low, usually less than 10%. However, seed (when not treated with boiling water) remains viable for at least 3 years, so seed pots can be kept for 2 or 3 years for further germination.

Seedlings can be pricked out (transplanted) when only a few days old; this isolates each seedling and reduces the risk of damping off disease, to which they are very susceptible.

CULTIVATION

The initial growth rate is slow; however, in August the seedlings start to grow rapidly and can begin to flower in November, about 7 months after germination.

The potting on mix is the same as the seed sowing mix. I do not use fertiliser in this mix, but plants will respond well to a

light dressing of slow release fertiliser. Too much fertiliser encourages soft growth and tends to make the plants more susceptible to pests and diseases.

When possible, try to grow the plants in full sun in the open, but not in an exposed, windy position. This will result in a tougher plant with darker green foliage. In Western Australia, where we have our fair share of bush flies during the warmer months of the year, the plants are extremely well fed.

Watering in cultivation, I find, should be regular and throughout the year. In cooler climates, when growing plants undercover, it may be easier to dry the plants off during late summer without causing the plants to dehydrate too much. Avoid watering overhead as this can reduce the amount of mucilage present on the plant, which could also weaken the plant by reducing the numbers of insects caught and also increase the energy required to keep producing the mucilage.

In Western Australia the two main reasons for plant losses are keeping the plants too dry during the summer and waterlogging due to bad drainage.

The Influence of pH and Nutrient Availability on the Distribution of *Sarracenia purpurea* (Pitcher Plant) in Three Southeastern Wisconsin Fens.

by Teresa Ann Golembiewski

The University of Wisconsin-Milwaukee, 1984
Under the Supervision of Dr. Forest Stearns

ABSTRACT

Temperature, pH, alkalinity, total-N, total-P, K, Na, Ca and Mg levels were measured in groundwater during the summer and fall at the Pickerel Lake and Ottawa Lake calcareous fens and the Cedarburg Bog patterned fen. The two calcareous fens were similar in all physical and chemical parameters. Alkalinity, pH and Mg were significantly lower in the patterned fen when compared to the calcareous fens, while the other physical and chemical parameters were similar at all three sites.

Each of the three southeastern Wisconsin fens supported *Sarracenia purpurea* (pitcher plant). In each fen the physical and chemical characteristics of the groundwater of the areas that supported *S. purpurea* were compared with that of areas that did not support *S. purpurea*. The distribution of *S. purpurea* in these three wetlands was not correlated with the measured groundwater characteristics.

Eleocharis rostellata was dominant in the calcareous fens, while *Rhynchospera alba* was the dominant plant of the patterned fen. *S. purpurea* appeared to form no vascular plant associations, although it often occurred in association with various mosses. In the two calcareous fens, *S. purpurea* usually grew near spring seeps.

Sarracenia purpurea occurred in greater density in the calcareous fens compared to the patterned fen. Clones in the calcareous fens reached larger size and contained more leaves than clones at the patterned fen.

Sarracenia purpurea was cultivated hydroponically under controlled conditions at three levels each of N, P, and K, in a complete nutrient solution and in double distilled water. The absence of K depressed *S. purpurea* growth. Levels of other nutrients showed little effect during the first eight months of growth.

JUDGING CARNIVOROUS PLANTS IN A PLANT SHOW

(by Judith B. Finn, Botanical Garden Asst. Manager, University of California, Berkeley, CA 94720)

The Annual Flower Show has no entry qualifications and age is also not taken into account so there is thus quite a variation in horticultural skills. The plants are divided into groups according to genus. If people submit a large container or terrarium with differing family groups, we do not judge it as a whole, but judge the individual genus contained within.

Our first priority is excellence in plant growth. The *proper cultivation* which leads to the best looking specimen is regarded as the most important aspect. We do not judge *rarity* in plant species. This hopefully discourages people from "buying" an award, or taking endangered plant species from the wild, or possible theft from collections. This also allows anyone, who has the diligence to raise to perfection even the most common species, equal chance to attain an award.

Because our judging is in August, we do not give special merit for a plant which happens to be in *flower*. The added beauty, though, probably adds a certain bias. The *size* of a plant is, also in itself, not considered an important point. If another smaller specimen of the same genus is more carefully cultivated it will be favored. When weighing the merits between two specimens, the *difficulty of cultivation* of one species over another is taken into consideration.

The following are some of the *points of cultivation* which we take into consideration:

The plant should have a certain symmetry unless that does not apply to a particular species.

The plants should be well groomed. The dad foliage should be eliminated and hopefully, no plant pathogens present—insect

THE DR. EDGAR T. WHERRY MEMORABILIA COLLECTION

Special Announcement *by Don Schnell*

There is a quite legitimate effort underway to collect and catalog any letters, other written material, slides, photographs and other memorabilia on Dr. Edgar T. Wherry. This project is being handled through the Delaware Valley Chapter of the American Rock Garden Society, and all material will be housed in the Wherry Collection of the Academy of Natural Sciences where it would be available to students and researchers.

If you have such material in your files, or know of individuals or institutions that do, please contact Mr. Milton Laden at 334 Wellesley Rd., Philadelphia, PA 19119. They would like to receive such materials either in original form or as good quality copies. Mr. Laden would also appreciate all ideas on expanding this collection, search and use of material.

I have already sent in all of the material published by and about Dr. Wherry in previous *CPN* issues, so that is taken care of. I also included some personal correspondence. Others of you may wish to include some of your own material.

The Collection has just acquired some 1,500 of Dr. Wherry's original glass plate slides, which include many of *Sarracenia*. These are being copied to modern 35mm format and sets will be suitably housed for inspection. The slides will also be cataloged for easy reference. I anticipate queries about sales of slides, but so far, there is no plan for this, since the original glass plates belong to Morris Arboretum.

pests, fungal spots, black sooty mold, etc. The growth medium should be neat—no slime mold, dead tips on live sphagnum, etc.

The container should be clean and in good condition—no chips, cracks, etc.

The plants should have been grown in the correct humidity so that there are no burnt tips. They should also have the correct sunlight so that if there should be color (red traps in venus fly traps) it is developed. If applicable, the plant should be compact and not showing excessive elongation from too much shade. On the other extreme, there should be no evidence of burn damage.

We also observe whether a plant has been newly potted, which may indicate that it is a composite. Although this shows concern for presentation, it can also mask poor cultural practices.

This list of judging criteria was formulated by Daniel Campbell and myself. It is certainly open to revision and improvement. Any suggestions would be appreciated.

THE 1986 LIST OF CP BOOKS

Not available through *CPN*. Order directly from publisher or your local bookshop.

* = books intended primarily for children.
□ = Books out-of-print

1. Carnivorous Plants, Gordon Cheers, Globe Press, Melbourne, $7.95.
2. Insectivorous Plants, Charles Darwin, AMS Press, 1893, 56 E. 13th St., N.Y., NY 10003, $27.50, 1893 ed.
3. * Plants that Eat Insects: A Look At Carnivorous Plants, Anabel Dean, Lerner Publications, 1977, 241 First Avenue, Minneapolis, MN 55401. $5.95.
4. Plants of Prey in Australia, Rica Erickson, Univ. of W.A. Press, 1968, World Insectivorous Plants, 2130 Meadowind Ln., Marietta, GA 30062, Cloth, $16.00.
5. □ * Animals & Plants That Trap, Phillip Goldstein, Holiday, 1974, Holiday House, Inc., 18 E. 53rd St., N.Y., NY 10022, $5.95.
6. Nepenthes of Mt. Kinabalu (in English), Kurata, S., Sabah National Park, World Insectivorous Plants, 2130 Meadowind Ln., Marietta, GA 30062, $7.00.
7. * Pitcher Plants, Carol Lerner, William Morrow & Co., N.Y. $11.00.
8. Carnivorous Plants, Francis E. Lloyd, Peter Smith, 6 Lexington Ave., Magnolia, MA 01930, $16.00, 1942 ed., paper $7.95, Dover Publns., 31 E. 2nd St., Mineola, NY 11501.
9. The World of Carnivorous Plants, J. and P. Pietropaolo, R.J. Stoneridge, Peter Paul Nurseries, 1974, $6.30.
10. □ * Insect-Eating Plants, L. and G. Poole, T.Y. Crowell, 1963, 666 Fifth Avenue, N.Y., NY 10003, $4.50.
11. * Plants That Eat Animals, J.H. Prince, Lodestar Bks., 2 Park Ave., N.Y., NY 10016, $8.95, 1979 ed.
12. CP of the U.S. and Canada, D.E. Schnell, John F. Blair, Publisher, 1976, 1406 Plaza Dr., SW, Winston-Salem, NC 27103, $19.95 plus shipping, 1976 ed.
13. Carnivorous Plants, Randall Schwartz, Avon Books, 1975, 959 Eighth Ave., N.Y., NY 10019, soft cover $1.25.
14. Pitcher Plants of Peninsular Malaysia & Singapore, Roger G. Shivas, Maruzen Asia Pte. Ltd., 51 Aver Rajah Crescent #07-09, Singapore 0513. $9.80.
15. Carnivorous Plants, Adrian Slack, MIT Press, 1979, 28 Carleton St., Cambridge, MA 02142, $28.00, 1980 ed., 1984 paper $12.50.
16. □ Cultivating Carnivorous Plants, Allen Swenson, Doubleday & Co., 1977. Garden City, NY 11535, $7.95.
17. □ * Carnivorous Plants, John F. Waters, Franklin Watts, Inc., 1974, 845 Third Avenue, N.Y., NY 10022, $4.90.
18. * Carnivorous Plants, Cynthia Overbeck, Lerner Publications, 1982, 241 First Avenue, Minneapolis, MN 55401, $10.95.
19. * Secrets of the Venus's Fly Trap, Jerome Wexler, Dodd, Mead & Co., 1981, 79 Madison Ave., N.Y., NY 10016, $8.95.

1986 CP SOURCES

Note: All individuals or organizations selling, trading, or buying CP are advised to be cognizant of certain restrictions under the U.S. ESA and international CITES for certain species (see editorial, CPN *12* 3, 1983).

Name and Address	Catalog Price	Stock
Cyril G. Brown 65 Highfield Cres. Hornchurch Exex RM 126PX		
Burleigh Park Orchid Nursery Ian & Pat Walters, 1419 Ross River Road, Kelso, TOWNSVILLE, QLD. 4815. Phone: 077 740008.		*Nepenthes*
Carnivorous Gardens P.O. Box 224 Stones Corner 4120 Brisbane, Queensland Australia	$ .75	*Native seed*
The Straits Aquariums Pte. Ltd. Lim Ah Pin Road Box 626 Singapore, 9154	free	*Malaysian Nepenthes*
Country Hills Greenhouse Rt. 2 Corning, OH 43730	$2.50 refundable with order	*Nepenthes (20 varieties)*
Exoticana Seeds P.O. Box 184 Greytown 3500, South Africa		*Native CP seed*
Heldon Nurseries Asbourne Rd. Spath Uttoxeter ST145AD		
Hinode-Kadan Nursery 2735 Nakanogo, Hacijyot Hachihyo-Island Tokyo 100-16 Japan	International Reply Coupon	*Byblis, Cephalotus, Drosera, Pinguicula, Nepenthes, Utricularia*
Hungry Plants 1216 Cooper Drive Raleigh, NC 27607	$ .50	*Byblis, Cephalotus, Dionaea, Drosera, Darlingtonia, Nepenthes, Pinguicula, Roridula, Sarracenia, Sphagnum and Utricularia. Tissue cultures of most stock.*
Marston Exotics Spring Gardens Frome Somerset, England	50 p	*Serving Britain & Europe only*

Milingimbi Nursery 69 Pringle Ave. Belrose, NSW 2085 Australia	Free	*Byblis, Cephalotus, Drosera, Dionaea, Nepenthes, Utricularia, Sarracenia, Pinguicula*
Orgel's Orchids Rt. 2, Box 90 Miami, FL 33187	Free	*Byblis, Dionaea, Drosera, Nepenthes, Pinguicula, Sarracenia, Utricularia*
Peter Pauls Nurseries Canandaigua, NY 14424	Free	*Sarracenia, Dionaea, Drosera, Utricularia, Darlingtonia, Nepenthes seed, Pinguicula, live Sphagnum*
ISRA Exotics P.O. Box 1200 B.S.B. Brunei, Borneo, SE Asia	Free	*Nepenthes*
Renate Parsley 8 Langton Rd. Mowbray 7700 South Africa		*Native CP Seed*
Sarracenia Nurseries Links Side Courtland Ave. Mill Hill, London NW7		
South West Seeds Doug & Vivi Rowland 200 Spring Rd. Kempston, Bedford MK428ND		
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The co-editors and CPN do not endorse any of the above vendors. This is being provided only as a service to our subscribers. Information correct at time of receipt. Please contact sources directly for further information. Not responsible for omissions. Inquiries for inclusion in future lists should include a catalog/price list of CP available, cost of catalog and address. Send information to J.A. Mazrimas, 329 Helen Way, Livermore, CA 94550.

Review of Recent Literature

Beaver, R.A., Geographical variation in food web structure in *Nepenthes* pitcher plants. Ecol. Entomol 10(3): 241-248 1985.

Nepenthes species that grow in areas outside of the evolutionary center of the genus in West Malaysia are found to have fewer species of both prey and predator living in them. Also, there are fewer species with more empty niche space to grow in. The Seychelles, Sri Lanka and Madagascar are three countries that show these differences which vary in relation to the size and spatial and temporal isolation of the country.

Murphy, J.D. Bjerklie, The living library of plants. Time Magazine, Nov. 4, 1985.

Botanist's estimate that some 3,000 of the 22,000 species of flowering plants in the United States may be facing extinction. On the world scale, about 40,000 plant species are in serious trouble. To help this situation, the Center for Plant Conservation with its center at the Arnold Arboretum of Harvard University received money to preserve every kind of threatened plant in the U.S. It hopes to secure in 10 years all the threatened specimens and grow them in their greenhouses. Seeds will be stored at the Dept. of Agriculture's Fort Collins, Colorado seed-storage facility. Eventually, they hope to reintroduce some plants into their natural habitats. It will eventually cost $5,000 to save each species. The Arboretum will accept this donation to save an endangered plant in your name.

Naeem, S. & J. Dushek, Plumbing the deathly depths of the California Pitcher plant. Pacific Discovery, April-June: 26-31 1985.

The authors conducted experiments on *Darlingtonia californica* in the field to study its carnivorous nature. For example, if they removed the fishtail appendage, the pitcher captures only 1/10 as many insects showing that secretions which bait the appendage attract insects. The pitchers contain naturally two specific species of arthropods—the water mite and the midge fly larva which live only in these pitchers. These inhabitants are chiefl responsible for the decomposition of prey! A single pitcher can contain up to 3,000 mites and several hundred midge fly larva to carry out this important job.

Studnicka, Miloslav. 1985. *Pinguicula rotundifolia*—A new species from Mexico. Fol. Geobot. Phytotax. 20:201-204, plts 15,16.

A new species of Mexican Pinguicula—*P. rotundifolia* is herein described from the southern part of Mexico. It is in cultivation in several botanical gardens (from which two good black and white photo plates are included). The species is closely related to and appears much like *P. parvifolia* but differs in the form of leaves, corolla lobes, color of the mouth of the corolla tube, dissimilarity of pilosity of the calyx, bare pedicels and several other lesser characters. The plant grows in calcareous soils under partial cover of semi-deciduous trees. DES

CP Articles Solicited

The editors of CPN would like to remind ICPS members that the publication depends on *their* contributions. Letters, articles and photos (both slides and black and white prints) are suitable material for submission to CPN. Material should be submitted to one of the co-editors (names and addresses listed inside the front cover).

WANT ADS

When submitting Want Ads, please be sure to print clearly for best results and to eliminate mistakes. Please circle the correct letter before each item (Want, Trade, Sell or Buy). Want ads are limited to carnivorous plants, terrariums, greenhouses and moss. There is a charge of ten cents per item, with no limit to the number of items you may submit per issue.

Send coin or check to:
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California State University
Fullerton, CA 92634

James Emrich (1125 Hayes Ave., Fremont, Ohio 43420.) (WB) any *Nepenthes* cuttings, *Dionaea muscipula, Sarracenia* (any species), *Darlingtonia californica, Drosera* (any species), *Cephalotus,* Live and Dried Sphagnum, Stamps showing C.P.

Ron Gagliardo, (1216 Cooper Drive, Raleigh, NC 27607) (WTB) North American *Pinguicula, Sarracenia rubra* ssp. *alabamensis, Drosera schizandra, adelae,* Pygmy *Drosera gemmae,* any fresh *Nepenthes* seed, *Drosera linearis, Drosera anglica, Aldrovanda.*

Jim Scott (1375 W. 1000 N., Markle, IN 46770) (WB) live moss, plants and/or seeds of *D. filiformis f. filiformis, D. filiformis f. tracyi, D. anglica, D. brevifolia, D. linearis, S. purpurea f. heterophylla, S. oreophila, S. flava* (all red), *S. flava* (heavy veined), *S. flava* (red throat), *P. alpina, P. caerulea, P. grandiflora, P. ionantha, P. lutea, P. macroceras, P. planifolia, P. primuliflora, P. pumila, P. villosa, P. vulgaris.*

Chas. Powell (2138 Harrison St., Santa Clara, CA 95050) (Trade) *Nepenthes gracilis, N. kampotiana, Sarracenia × Rehderi, S. rubra, Pinguicula hirtiflora, P. esseriana, P. moranensis × P. ehlersia, Utricularia dusenii, U. livida,* and other. (Want, Trade) *Heliamphora nutans, Nepenthes globamphora, N. northiana, Drosera erythorhiza, D. macrophylla, D. auriculata* (bulbs), *D. bulbosa, D. drummondii, D. miniata, D. neo-caledonica, D. pycnoblasta, D. scorpioides, Pinguicula lusitanica, P. colimensis, Utricularia capensis, U. hookeri, U. nephrophylla,* and others.

ACTION POTENTIALS, continued from page 17.

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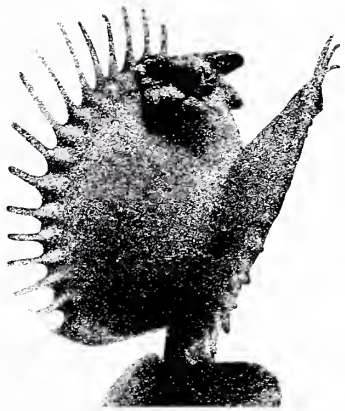

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